

**What is claimed is:**

1. An apparatus for cleansing air, comprising:
  - a) a source of microwaves that couples with or attenuates contaminants or impurities in air to cause destructively dipolar polarization, electrical coupling, hydrolysis, and/or interfacial polarization of the contaminants;
  - b) a contaminant containment structure housed by a microwave-reflective enclosure having opposing ends, gas containing the contaminants or impurities passing through the contaminant containment structure and microwave reflective enclosure as the gas is exposed to microwaves, the contaminant containment structure being made from materials which are invisible or nearly invisible to the microwave frequencies;
  - c) a gas permeable material covering each end of the microwave-reflective enclosure, the gas permeable material having openings of a size that prevent microwaves to escape.
2. An apparatus for cleansing one or more solids or liquids, comprising:
  - a) a housing including source of microwaves that deeply penetrates and is directly absorbed by contaminants or impurities on the surface of, within the recesses or interstices of, or surrounded by solid objects which are microwave permeable or by contaminants or impurities contained in the liquids to cause destructive dipole polarization, electrical coupling, hydrolysis, and/or interfacial polarization of the contaminants or impurities,
  - b) microwave-reflective enclosure for containing the one or more solids or liquids, and a supportive structure within the housing and sized to hold at least liquids being treated, the supportive structure made from materials which are invisible or nearly invisible to the microwave frequencies; and

c) a passageway in the microwave reflective enclosure and a gas permeable material covering the passageway, the gas permeable material having openings too closely spaced to permit microwaves to escape, the passageway allowing thermal expansion within the microwave radiated atmosphere;

d) optionally a source of water, water vapor, steam, or hydrogen if the atmosphere in the enclosure or the liquids do not include a sufficient quantity of water.

3. The apparatus of claim 1 or 2, wherein the source of microwaves uses a microwave frequency between 433 and 435 MHz, 902 MHz and 928 MHz, or 2.4 and 2.5 GHz.

4. The apparatus of claim 1, wherein the contaminant containment structure is made from materials selected from the group consisting of alumina, Pyrex® glass, quartz, sapphire, silicon nitride, or polymer.

5. The apparatus of claim 2, wherein the support structure is made from materials selected from the group consisting of alumina, Pyrex® glass, quartz, sapphire, silicon nitride, or polymer.

6. The apparatus of claim 1 or 2, wherein gas permeable material is one a screen material, perforated metal, or wire mesh.

7. The apparatus of claim 1 or 2, wherein gas permeable material is covered with a metal catalyst taken from Group VIII metal of the Periodic Table.

8. The apparatus of claim 1, wherein a surface of the contaminant containment structure in contact with contaminated air includes one of yttrium oxide, carbon, iron, a rare earth oxide, or titanium oxide.

9. The apparatus of claim 1 or 2, further comprising a source of one or more of water, water vapor, steam or hydrogen for addition to the air.

10. The apparatus of claim 9, wherein the hydrogen is up to 4% of the atmosphere within the housing.

11. The apparatus of claim 2, wherein the supportive structure is a container adapted to hold one or more of the solids or liquids.

12. A method of destroying contaminants in air comprising:  
a) providing a source of contaminated or impurity laden air; and  
b) subjecting the air to microwaves in the presence of one or more of water, water vapor, steam, or hydrogen for dipole polarization, electrical coupling, hydrolysis, and/or interfacial polarization of the contaminants.

13. A method of destroying contaminants/impurities on one or more solids or liquids comprising:

a) providing one or more contaminated or impurity laden solids or liquids;  
b) placing at least the one or more contaminated or impurity laden liquids in a supportive structure;  
c) subjecting the one or more solids or liquids to microwaves for dipole polarization, electrical coupling, hydrolysis, and/or interfacial polarization of the contaminants/impurities associated with at least the one or more solids being in the presence of water, water vapor, or steam, or hydrogen.

14. The method of claims 12 or 13, wherein the impurities or contaminants comprise bacteria, viruses, fungal metabolites, spores, volatile chemicals and proteins.

15. The method of claims 12 or 13, wherein one or more of the following apply:

the spores are formed by endospore forming bacillus, the bacteria is clostridium botulinum, the protein is ricin, the proteins include prions, and the volatile chemicals comprise organofluorophosphonate acid esters, organothiophosphonate acid esters, 1,1'-thiobis[2-cloroethane], 2-cloro-N-(2-cloroethyl)—methylethanamine, and dichloro(2-chlorovinyl)arsine.

16. The method of claim 12, wherein the contaminated air contains one or more impurities that increase the rate of hydrolysis.

17. The method of claim 16, wherein the impurity comprises one or both of carbon- or iron-containing materials.

18. The method of claims 12 or 13, wherein a molar ratio of water and/or hydrogen to an amide-radical group found in the contaminant/impurity is at least one to one.

19. The method of claims 12 or 13, wherein hydrogen in the atmosphere comprises up to 4% by volume.

20. The method of claim 13, wherein the solids further comprise paper or paper-containing objects, garments, fabrics, wood, concrete, bricks, concrete blocks, earth, stone, wood, and foods such as meat, and the liquids comprise waste water derived from a contaminated site clean up.

21. The method of claim 12, further comprising adding an amount of one or more of water, water vapor, steam, or hydrogen to the atmosphere.

22. The method of claims 12 or 13, further comprising introducing a metal catalyst from Group VII of the Periodic Table or carbon during the subjecting step.

23. The method of claim 22, wherein the metal catalyst from Group VII of the Periodic Table or carbon is included with the gas permeable material.

24. An apparatus for treating paramagnetic dust, particularly in underground railways comprising:

- a) a source of paramagnetic dust-containing air;
- b) ductwork having an entry for receiving the paramagnetic dust-containing air and an exit for discharging essentially dust free air;
- c) an electromagnet positioned adjacent the ductwork and between the entry and exit for collecting the paramagnetic dust when powered.

25. The apparatus of claim 24, wherein the ductwork is in the shape of an elbow with one generally vertical leg, the generally vertical leg containing the entry, the electromagnet positioned at the direction change of the elbow, so that depowering of the electromagnet releases collected paramagnetic dust for collection at the entry of the elbow.

26. A method of cleansing contaminated air containing paramagnetic dust particles comprising:

- a) providing a stream of air that contains the paramagnetic dust particles;
- b) providing an electromagnet;

c) passing the stream of air through an electromagnetic flux generated by the electromagnet to remove the paramagnetic dust particles from the stream; and

d) optionally depowering the electromagnet to release the removed paramagnetic dust for collection.

27. The method of claim 26, further comprising shielding the electromagnet using magnetic shielding materials so that only the stream of air is subjected to the electromagnetic flux.

28. The method of claim 26, wherein the stream of air comes from an underground railway.

29. The method of claim 26, wherein the magnetic shielding materials are used to protect rail passengers in the underground railway.